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Comparison of long vs short proximal femoral nailing with PFNA2 in intertrochanteric fractures

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Abstract
Aim: A comparative evaluation of the surgical treatment and outcome of patients with stable intertrochanteric fractures treated with long versus short PFNA2.
Objectives: Inter-trochanteric fractures of femur are among the most common orthopedic injury in elderly age group. Proximal femoral nailing with A2 screws has recently become a popular method of stabilization of inter-trochanteric fractures in adults. Stable trochanteric fractures can be treated using the conventional proximal femoral nailing method or the newly deviced proximal femoral nailing with A2 screws. The present study was conducted to assess and evaluate the outcomes following treatment of stable inter-trochanteric fracture femur with proximal femoral nail A2 long vs short proximal femoral nail A2.

Keywords: intertrochanteric fracture, PFNA2, short, long nail

Introduction

Globally, proximal femoral fractures have been on the rise with the increase in life expectancy and osteoporosis in the elderly population and road traffic accidents among the younger counterparts [1, 3]. The total number of trochanteric fractures are predicted to reach 1.6 million by 2025 and 2.5 million by 2050 [4]. In 1990, 26% of all intertrochanteric fractures were reported in Asia, this figure is estimated to rise to 32% in 2025 and 38% in 2050.

Intertrochanteric fractures are a common injury in geriatric patients with osteoporosis or an underlying disease. Similar to most hip fractures among the elderly, intertrochanteric fractures occur subsequent to a lateral fall that has an impact on the greater trochanter. The overall intertrochanteric fracture prevalence, severity, and risk of unstable fracture morphologies show a relationship with the severity of trochanteric osteoporosis. Even though the direction of impact has an effect on the overall risk of hip fracture, an absolute correlation between impact direction and fracture location or morphology is not evident [5, 6]. Unstable intertrochanteric fractures in the elderly is linked to a high mortality rate, nearly 20%, in the first postoperative year [7].

In intertrochanteric fractures, there is an increase in the bending effect of the joint load since the lever arm (distance between line of action of hip joint load & fracture line) is longer. This leads to bending of the proximal fragment in the varus direction. Shear forces acting on such fractures are not major. The axial rotation force acting on femoral shaft during internal or external rotation of limb is important and may interrupt fixation. During fixation, it is essential for the bone to support load, so that the load on the implant is less. In comminuted fractures, the stress on the implant is comparatively more as the implant bears more load than bone support.

Clinical attention is generally given to the number, size, shape, location and displacement of fracture fragments. Comminution encompasses the posteromedial cortex of bone acting as a major contributing factor for complication of fixation. Multiple fragments with posteromedial cortex comminution are likely to displace in varus and retroversion, consequently considered as unstable fractures [8]. Apart from comminution and displacement, additional key features for intertrochanteric fractures include orientation of the fracture line and stability. A typical intertrochanteric fracture has a primary fracture line oriented from the greater trochanter (proximal and lateral) to the lesser trochanter (distal and medial). For the typical orientation, a primary fracture line connotes stability. The goal for treating such injuries is to reduce displacement and stabilize with implants to allow early mobilization and weight bearing during fracture healing [5].

Today, with the improvements in treatment modalities, surgical treatment has been established as a standard of management to achieve adequate reduction and early mobilization in the elderly osteoporotic population. Attaining successful fixation is of utmost importance in this group since implant failure can result in devastating complications.

In 2003, the AO/ASIF group designed the PFNA such that it would improve the rotational and angular stability using a single element [9]. It was developed to achieve superior fixation strength in osteoporotic bones, by means of a simpler technique as compared to other implants. The PFNA blade inserted accomplishes an exceptional fit via bone compaction and entails less bone removal when compared to a screw. Biomechanical investigations have revealed the blade to have a significantly higher cut-out resistance as opposed to commonly used screw systems. The PFNA blade may possibly be a more apt biomechanical implant for trochanteric fractures in osteoporotic bone and for unstable

trochanteric fractures. Nonetheless, a vigilant and sufficient insertion of the blade or lag screw may be given more attention rather than biomechanical stability alone [10].

Fig 1: PFN A2 implant used

Biomechanically, the PFNA, owing to its single element large surface and improved core diameter demonstrates greater resistance to cut-out and superior rotational stability with an assurance for maximum compaction and optimal hold in the bone [11] It exhibited enhanced resistance to varus collapse and femoral head rotation, extended fatigue life. The 11.0 mm helical blade reduces the amount of bone resected from the neck. The flexible tip of the PFNA decreases the stress on the bone at the tip that reduces implant failures (distal nail breakage and distal locking screw breakage) [12].

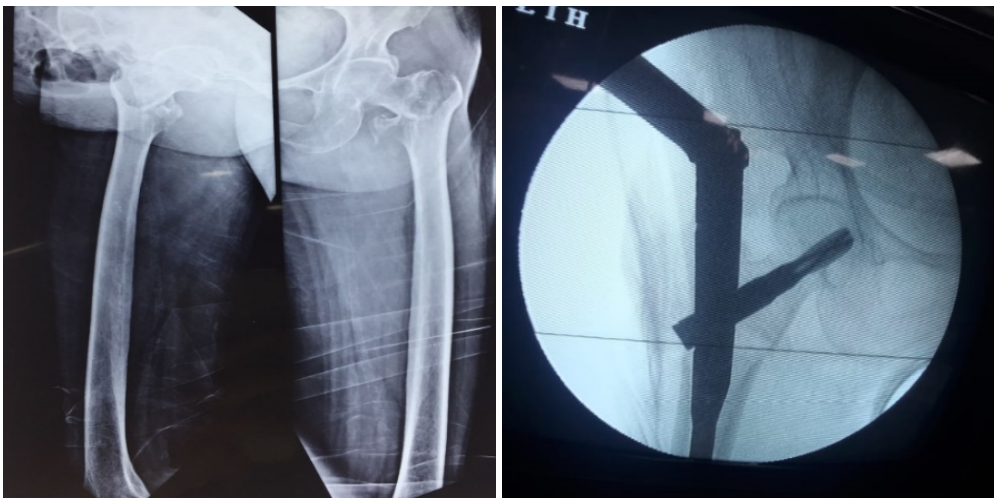
Major Advantages of PFNA

- The PFNA involves gentle tapping of the helical blade over a guide pin thereby avoiding the steps involved in reaming of canals for lag screw and de-rotation screw as required in a PFN.
- The positioning of the guide wire, used in the PFNA technique, for the insertion of the helical blade, is comparatively easier as compared to two guide wires used for PFN.
- The PFNA blade enhances fixation stability diminishing bone loss of the remaining bone stock, increases contact area between implant and femoral head and compacts the cancellous bone [2, 12, 13].
- Few studies have demonstrated that the femoral anterior arch of the PFNA2 does not match the anatomy of Asian patients. Among the short-nail models of the PFNA2 (170 mm), only about 19% of the distal tip of the nail are located in the central of needle canal, 74.7% located in the former, and 6.3% in the rear of the needle canal, not to mention the long nail. There is contact irritation between the inappropriate nail tip position and the femoral cortex that tend to increase patient discomfort and pain. It was concluded that both the short and long nails (nail length of ≤24 cm) require a curved design that would be more suitable for the femoral anterior arch shape in Asian patients [14, 15].

The PFNA2 nail is available in 4 sizes:-Small length 170mm, Small length 200 mm, Medium length 240mm, Large length 260mm-420mm.The PFNA2 long nail additionally for secondary dynamization.
This study aims for correlating functional outcome short PFNA2 & long PFNA2 within the terms of blood loss, surgical time, functional outcome and other modalities.

Materials and Methods

A prospective review was conducted of patients with stable intertrochanteric fractures treated between January 2019 and june 2020. In all 80 patients were enrolled in the study, of which 40 were treated with short PFNA2and the remaining 40 with long PFNA2. Comparative analysis of demographic data, peri-operative outcome and complications were carried out. All fractures were classified as per Orthopedic Trauma Association(OTA) AS 31A1.1-31A1.3.All the patients were evaluated on immediate post-operatively, 1st, 3rd, 6th and 12th month using Harris hip score.



Preop Intra-Op

Fig 2

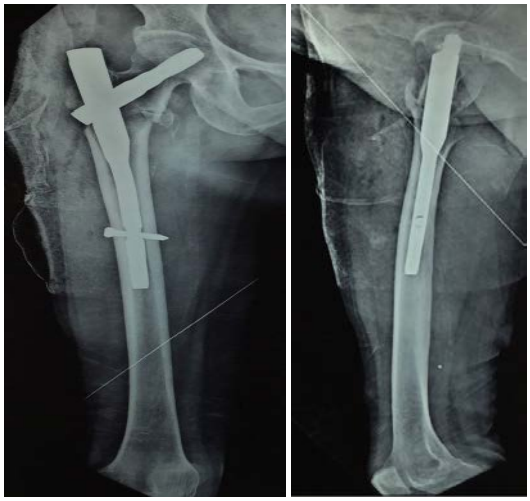


Fig 3: Post op

Age
The mean ± SD age in patients of Group A(long PFNA2) was 67.56 ± 15.13 years while that of those in Group B(short PFNA2) was 61.16 ± 16.29 years. The t-test revealed no statistically significant difference (p=0.1565) between the mean age of patients in the 2 groups.

Gender Distribution
Of the 40 patients in Group A, 40% were males and 15% were females, whereas in Group B, 52% were males and 48% were females. The chi-square test revealed no statistically significant difference (p=0.3946) between the distribution of gender among the groups.

Mode of Injury
In the present study, the mode of injury was RTA in 24% patients in Group A (LONG PFNA2) and 40% patients in Group B(SHORT PFNA2), whereas fall was the mode of injury in 76% patients in Group A and in 60% patients in group B. The chi-square test revealed no statistically significant difference (p=0.2252) between the mode of injury among the 2 groups.

Table 1: AO classification (Stable Intertrochanteric Fractures

AO classification	Group A		Group B	
	No.	%	No.	%
31 A1.1	2	5	3	8
31 A1.2	16	40	15	37
31 A1.3	12	30	10	25
31 A2.1	10	25	12	30

Type of Anaesthesia
Spinal anaesthesia was used for majority of our patients, i.e. in 88% patients in Group A and in 92% patients in Group B. In the remaining, 12% patients in Group A and 8% patients in Group B, spinal/epidural anaesthesia was used.

Blood loss

Table 2: Blood loss

Blood loss	Group A		Group B		p-value*
	No.	%	No.	%	
<100 mL	6	15	30	75	0.00001
≥100 mL	34	85	10	25	

*Calculated using the chi-square test. P<0.05 considered statistically significant

Blood transfusion

Table 3: Blood transfusion

Blood transfusion	Group A		Group B		p-value*
	No.	%	No.	%	
Yes	35	88	2	4	<0.00001
No	5	12	38	96	

*Calculated using the chi-square test. P<0.05 considered statistically significant

Intraoperative Complications
Among the two groups in the present study, intraoperative complications were noted only in 8% patients treated using LONG PFNA2. There were no intraoperative complications among patients treated using SHORT PFNA2.

Post-Operative Complications
In our study, there were no early post-operative complications among any patients in both groups treated using either long PFNA2 or short PFNA2. However, late post-operative complications were observed in 12% patients treated using long PFNA2, 1 patient had screw back-out, 1 had screw breakage and 1 had stress fracture. There was 1 late post-operative complications among patients treated using PFN A2 screws and that was fracture shaft of femur from the tip of nail of the operated side.

Fig 4: Helical screw backout

Harris HIP Score
The mean ± SD HHS in patients of Group A was 85.32 ± 12.96 while that of those in Group B was 83.36 ± 11.57. The t-test revealed no statistically significant difference (p=0.5753) between the mean HHS of patients in the 2 groups.

Fluoroscopy Shoots

Table 4: Fluoroscopy Shoot (In Nos.)

Shoot	Group A		Group B		p-value*
	Avg No.	%	Avg No.	%	
>40	37	92.5	2	4	0.00001
<40	3	7.5	38	96	

*Calculated using the chi-square test. P<0.05 considered statistically significant

Operative Timing

Table 5: Opereative Timing

	Group A		Group B		p-value*
	Avg No.	%	Avg No.	%	
>60 mins	36	90	5	12.5	0.00001
<60 mins	4	10	35	92.5	

*Calculated using the chi-square test. P<0.05 considered statistically significant

Results

The mean follow up period was 15 months.There was not much significant difference noted in the two groups with regards to Arbeitsgemeinschaft fur Osteosynthesefragen (AO) fracture classification, time from injury to surgery & hospital stay. The surgical duration for a short PFNA2 procedure was significantly less (averaging 56 minutes) when compared to that of a long PFNA2 (averaging 88 minutes). Fluoroscopy exposure time was more in long PFNA2 group than short PFNA2 group. Similarly, intra-operative blood loss was significantly higher in the long PFNA2 group as compared to the short PFNA2**.**

Conclusion

A relatively quicker surgical time of just under an hour, Less radiation exposure and lesser blood loss makes short PFNA2 a better implant choice in the treatment of stable intertrochanteric fractures.

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Coflicts of Interest

There are no Conflicts of Interest.

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